



Summary: Hearing Screening

Faroe Islands

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1. Glossary of Terms: Hearing Screening

| | |
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| Abnormal test result | A test result where a normal “pass” response could not be detected under good conditions. The result on screening equipment may indicate “no response,” “fail,” or “refer.” |
| Attendance rate | <p>The proportion of all those <u>invited for screening</u> that are <u>tested and receive a result</u>,</p> <ul style="list-style-type: none"> • <u>Invited for screening</u> includes all those that are offered the screening test. • <u>Tested and receive a result</u> could be a “pass” or “fail”. <p>Attendance rate provides information on the willingness of families to participate in screening.</p> |
| Attendance rate in first year of life | <p>See definition of Attendance rate.</p> <p>The calculation cut-off is after <u>one year of life</u>.</p> |
| Compliance with referral (percentage) | <p>The percentage of those who are <u>referred from screening</u> to a diagnostic assessment that actually <u>attend</u> the first diagnostic assessment.</p> <p>Percentage of compliance provides information on the willingness of families to attend the diagnostic assessment after referral from screening.</p> |
| Coverage | <p>The proportion of those <u>eligible for screening</u> that are <u>tested and receive a result</u> within a <u>specific time</u>.</p> <ul style="list-style-type: none"> • <u>Eligible for screening</u> includes those within the population that are covered under the screening or health care program. • <u>Tested and receive a result</u> could be a “pass” or “refer to diagnostic assessment”. • <u>Specific time</u> can be defined, such as 1 month after birth, 3 months after birth, etc. <p>Coverage provides information on the overall effectiveness and timeliness of a complete screening programme.</p> <p>Factors such as being offered screening, willingness to participate, missed screening, ability to complete the screen, and ability to document the screening results will influence the coverage.</p> |
| Coverage in first year of life | <p>See definition of Coverage.</p> <p>The <u>specific time</u> is pre-defined as within the first year of life.</p> <p>In other words, the coverage is the proportion of those eligible for screening that complete the screening sequence to a final result within the first year of life.</p> |
| False negatives | The percentage of <u>infants/children with a hearing loss</u> (defined by the target condition) that <u>receive a result of “pass”</u> during screening. |



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| | Example: If 100 infants with hearing loss are screened, and 1 infant passes the screening, the percentage of false negatives is 1%. |
| False positives | <p>The percentage of <u>infants/children with normal hearing</u> that <u>receive a result of “fail”</u> from the final screening test.</p> <p>Example: If 100 infants with normal hearing are screened, and 3 infants fail the screening and are referred for diagnostic assessment, the percentage of false positives is 3%.</p> |
| Guidelines | Recommendations or instructions provided by an authoritative body on the practice of screening in the country or region. |
| Hearing screening professional | A person qualified to perform hearing screening, according to the practice in your country or region. |
| Inconclusive test result | A test result where a normal “pass” response could not be detected due to poor test conditions. |
| Invited for screening | Offered screening. |
| Outcome of hearing screening | An indication of the effectiveness or performance of screening, such as a measurement of coverage rate, referral rate, number of infants detected, etc. |
| Permanent hearing loss | <p>A hearing impairment that is <i>not</i> due to a temporary or transient condition such as middle ear fluid.</p> <p>Permanent hearing loss can be either sensorineural or permanent conductive.</p> |
| Positive predictive value | <p>The percentage of infants/children referred from screening who have a confirmed <u>hearing loss</u>, as described by your protocol or guideline and indicated in the Target Condition (see definition).</p> <p>For example, if 100 babies are referred from screening for diagnostic assessment and 90 have normal hearing while 10 have a confirmed hearing loss, the positive predictive value would be 10%.</p> |
| Preschool or (pre)school children | All children between 3-6 years of age. |
| Preschool or (pre)school screening | <p>Screening that takes place during the time children are between 3-6 years of age.</p> <p>This refers to <i>any</i> hearing screening during this age. The location of the screening is irrelevant to the definition.</p> |



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| Prevalence | The number or percentage of individuals with a specific disease or condition. Prevalence can either be expressed as a percentage, proportion, or as the value per 1000 individuals within the same demographic. |
| Programme | An organized system for screening, which could be based nationally, regionally or locally. |
| Protocol | Documented procedure or sequence for screening, which could include which tests are performed, when tests are performed, procedures for passing and referring, and so forth. |
| Quality assurance | A method for checking and ensuring that screening is functioning adequately and meeting set goals and benchmarks. |
| Referral criteria | <p>A pre-determined cut-off boundary for when an infant/child should be re-tested or seen for a diagnostic assessment.</p> <p>For example, referral criteria may be “no response” at 35 dB nHL.</p> |
| Risk babies / Babies at-risk | <p>All infants that are considered to be at-risk or have risk factors for hearing loss according to the screening programme.</p> <p>Two common risk factors are admission to the neonatal-intensive care unit (NICU) or born prematurely. However, other risk factors for hearing loss may also be indicated in the screening programme.</p> |
| Sensitivity | <p>The percentage of infants/children with hearing loss that are identified via the screening program.</p> <p>For example, if 100 babies with hearing loss are tested, and 98 of these babies are referred for diagnostic assessment while 2 pass the screening, the sensitivity is 98%.</p> |
| Specificity | <p>The percentage of infants/children with normal hearing that pass the screening.</p> <p>For example, if 100 babies with normal hearing are tested, and 10 of these babies are referred for diagnostic assessment and 90 pass the screening, the specificity is 90%.</p> |
| Target condition | <p>The hearing loss condition you are aiming to detect via your screening programme. This includes:</p> <ul style="list-style-type: none"> • The <u>laterality of the condition</u>, whether the program aims to detect both unilateral and bilateral hearing loss or just bilateral hearing loss. • The <u>severity of the condition</u>, whether the program aims to detect hearing loss ≥ 30 dB HL, ≥ 35 dB HL, ≥ 40 dB HL or ≥ 45 dB HL |
| Well, healthy babies | <p>Infants who are <i>not</i> admitted into the NICU or born prematurely.</p> <p>Well, healthy babies may or may not have additional risk factors for hearing loss, according to the procedures indicated in the specific screening programme.</p> |



2. Abbreviations

ABR – auditory brainstem response

aABR – automatic auditory brainstem response

ANSD – auditory neuropathy spectrum disorder

ASSR – auditory steady-state response

CI – cochlear implant

CMV – cytomegalovirus

dB HL – decibel hearing level

dB nHL – decibel normalized hearing level

dB SNR – decibel signal-to-noise ratio

DPOAE – distortion product otoacoustic emissions

HA – hearing aid

NICU – neonatal intensive care unit

OAE – otoacoustic emissions

TEOAE – transient-evoked otoacoustic emissions



3. Background

In the Faroe Islands, childhood hearing screening is implemented nationally across the islands.

The following report contains information with regards to hearing screening on the Faroe Islands.

3.1. General

The Faroe Islands are an autonomous constituent nation within the Kingdom of Denmark with a total area of 1400 km² across 18 islands and a population of 50 250 as of 2017 (Statistics Faroe Islands, 2018). On the Faroe Islands, each birth is registered. The number of live births on the Faroe Islands was 607 in 2015 and 686 in 2016 (Heilsulýsing Landslæknans, 2017).

The World Bank income classification categorizes Faroe Islands as a high-income country (The World Bank, 2018). The gross domestic product (GDP) was €45 999 per capita as of 2015 (Statistics Faroe Islands, 2018).

Health expenditure per capita on the Faroe Islands is unknown.

Data from the 2016 United Nations Demographic Yearbook do not calculate infant mortality rate for the Faroe Islands in 2015, as only one death was reportedly recorded (United Nations Statistics Division, 2016). The Medical Report from the Chief Medical Officer on the Faroe Islands indicates an infant mortality rate of 2.9 per 1000 in 2016 (Heilsulýsing Landslæknans, 2017).

3.2. Neonatal hearing screening

On the Faroe Islands, neonatal hearing screening is conducted universally, with all babies in the country having access to hearing screening, though participation is not obligatory for parents. Neonatal hearing screening for well babies started and was fully implemented on the Faroe Islands in 2014, though it started much earlier in Denmark. For infants at risk, screening was implemented in 2006. Neonatal hearing screening is funded through the government and embedded in the Preventive Child Health Care screening system.

Neonatal hearing screening is organized by the ENT staff at Thorshaven, which is the main hospital on the Faroe Islands and also houses the maternity ward. National guidelines are available, and protocols are equal across the country.

3.3. Preschool hearing screening

Hearing screening is performed on the Faroe Islands for children starting school at the age of 7 years. Screening school-age children began decades ago and is carried out universally. School screening is also funded by the government and embedded in the Preventive Child Health Care screening system.



4. Guidelines & Quality Control

National guidelines for hearing screening and a hearing screening protocol exist on the Faroe Islands, and is the same national guidelines used in Denmark (Sundhedsstyrelsen, 2012).

The content of the general hearing screening programme was decided on by the public health care system, and has not been changed since implementation.

The results of neonatal hearing screening are recorded by the ENT department in the patient journals; however, data are not collected on outcome measures such as coverage or referral rates, due to lack of manpower.

Annual reports are available only for all of Denmark, and not specifically for the Faroe Islands.

Studies have only been performed in Denmark on hearing screening effectiveness.



5. Process: Screening, Diagnosis, Intervention

5.1. Neonatal hearing screening

On the Faroe Islands, all infants are screened in the hospital. It is roughly estimated that only a few infants are born at home each ear and close to 100% are born in maternity hospitals. The average length of stay in the maternity hospital for well infants is up to 5 days and longer for premature infants. Families are invited to participate in screening via a letter or directly in person at the hospital by the ENT department.

The target condition for screening is not defined in protocol but is based on typical screening equipment thresholds.

Neonatal hearing screening for all infants should be completed before 6 months of age. Screening at-risk infants may be performed either by the ENT department on the Faroe Islands or the maternity department at the Righospitalet in Copenhagen if they are transferred to Denmark for care.

There are no differences in protocol for screening well or risk infants. The only infants screened differently are those with microtia or SUCLA 2 deficit.

Data are unavailable on the prevalence of CMV infections or meningitis on the Faroe Islands.

5.2. Neonatal diagnostic assessment

The diagnostic assessment for well and at-risk infants should be completed before 6 months of age. Infants are referred for diagnostic assessment at the audiology department at KAS Gentofte/Rigshospitalet in Copenhagen where ASSR and other diagnostic tests are performed.

5.3. Preschool hearing screening

The target condition is a threshold at any pure-tone frequency worse than 20 dB HL.

5.4. Intervention approach

On the Faroe Islands, treatment options available include grommets, hearing aids, bone conductive devices, and cochlear implants. It is estimated that infants are fitted with hearing aids and cochlear implants from 6-12 months of age. Cochlear implantation is performed in Copenhagen.

There are no specific fitting guidelines for hearing aids on the Faroe Islands; hearing aids are provided on an individual basis provided that they are providing benefit.



6. Protocols

Hearing screening protocols are described for neonatal hearing screening (well and at-risk) as well as for preschool hearing screening when applicable.

- The Test performed is the screening technique used
- The Age of the child is indicated in hours, days, months or years
- Referral criteria may be the lack of an OAE response at specified frequencies, a response-waveform repeatability constant, the absence of an aABR response at a specified intensity, or an absent behavioural response at a specified intensity. Referral criteria may be defined within a protocol or limited based on the device used.
- The Device is the screening device used.
- Unilateral Referrals indicates whether children are referred if only one ear fails screening.
- The Location is where the screening takes place

6.1. Neonatal hearing screening (well)

Table 1: Screening process for well babies on the Faroe Islands.

| Test | Age | Referral criteria | Device | Unilateral Referrals? | Location |
|-------------|------------|-------------------------------|---------------|------------------------------|---------------------------------|
| OAE1 | 3-5 days | 8x peaks of alternating-signs | Accuscreen | Yes | Maternity ward / ENT department |
| OAE2 | Undefined | | | | |
| aABR | <6 months | 35 dB nHL | | Yes | ENT department |

6.2. Neonatal hearing screening (at-risk)

On the Faroe Islands, there is no difference in the screening protocol between well, healthy infants and infants that may be at-risk for hearing loss. Infants under critical condition may be transferred to the Rigshospitalet in Copenhagen, Denmark, where the infant would then undergo the hearing screening protocol outlined in the report for Denmark.

6.3. Preschool hearing screening

Pure-tone audiometry is performed in schools for all 7-year olds on the Faroe Islands. There are no set referral criteria, except for a general suspicion for hearing loss.



7. Professionals

7.1. Neonatal hearing screening (well)

Screening for well babies is performed by nurses from the ENT department. Two nurses are responsible for all screening on the Faroe Islands. Nurses are supervised by the ENT physician and audiologist assistant in the ENT department.

7.2. Neonatal hearing screening (at-risk)

Screening for at-risk infants is performed by one of the 2 screening nurses, as with well babies, or by staff at the Rigshospitalet Denmark if the infant is transferred to Copenhagen for intensive care.

7.3. Preschool hearing screening

School screening is performed by a health-care nurse.



8. Results: Neonatal Hearing Screening

8.1. Coverage and attendance rates

On the Faroe Islands, the coverage and attendance rate are estimated to be almost 100%. It is estimated that 100% of at-risk infants are invited for hearing screening. No actual data are available on the exact number of infants screened per year.

8.2. Referral rates

No actual data are available on the pass rates for each screening test or the final referral rates.

Table 2: Estimated referral rates for neonatal hearing screening on the Faroe Islands

| Test | Referral Rate |
|------|---------------------------------|
| OAE1 | Around 90 % (Rough estimate) |

Referral rates assume 100% attendance. Rates reflect the number of infants referred out of the number of infants screened at each step.

In total, the total referral rate to a diagnostic assessment after the screening process is roughly estimated to around 0.5%. Approximately 3-5 children per year are transferred to Copenhagen for diagnostic assessment.

8.3. Diagnostic assessment attendance

The compliance rate for a diagnostic assessment after neonatal hearing screening is roughly estimated to be all infants. As indicated, diagnostic assessment occurs in Copenhagen.

8.4. Prevalence / Diagnosis

The prevalence of all childhood hearing loss (any degree) on the Faroe Islands is estimated to be 1 in 1300.

The prevalence of bilateral auditory neuropathy in well or at-risk babies is unknown.

8.5. Treatment success

It is unknown how many children with hearing impairment are fitted with hearing aids or cochlear implants each year.

8.6. Screening evaluation

Data are not available. False negatives and positives are roughly estimated to be few to none.

9. Results: Preschool Hearing Screening

9.1. Coverage and attendance rates

The estimated coverage and attendance rate for school screening is likely 100%. No actual data are available.

9.2. Referral rates

It is roughly estimated that 2-5% of children are referred for follow-up after school screening. No actual data are available.

9.3. Diagnostic assessment attendance

Data are unavailable regarding the rate of compliance for a diagnostic follow-up after referral from school screening.

9.4. Screening evaluation

Data are not available.



10. Costs: Neonatal Hearing Screening

There has not been a cost effectiveness analysis completed on the Faroe Islands.

10.1. Screening costs

It is estimated that costs are 150 000 DKK (€20 096) per year for neonatal hearing screening on the Faroe Islands, or 200 DKK (€27) per infant. These costs only cover screening and do not include transfer costs to Denmark for diagnostic assessment.

10.2. Equipment costs

Costs for OAE/ABR equipment is roughly estimated to cost 25 000 DKK (€3348) and is estimated to be replaced every 4 years. The costs for disposables is undefined.

10.3. Staff costs

There are 2 nurses that perform neonatal hearing screening on the Faroe Islands. The salary costs per year for hearing screening professionals is unknown. The training costs are unknown.

10.4. Diagnostic costs

Diagnostic costs are not indicated. The diagnostic assessment is not performed on the Faroe Islands, but in Denmark.

10.5. Amplification costs

On the Faroe Islands, all children are treated for hearing impairment. The cost for hearing aid intervention for the first year is unknown, but the cost for hearing aid intervention after the first year is roughly estimated to be 2000 DKK (€268) per year. Cochlear implant intervention is estimated to cost 450 000 DKK (€60 287) for the first year and 10 000 DKK (€1340) per year after the first year of intervention.

10.6. Social costs

There are no specialized schools on the Faroe Islands for deaf and hard-of hearing students. Children with hearing impairment are supported in schools with special assistance. Support is provided and funded by the school system.



11. Costs: Preschool Hearing Screening

11.1. Screening costs

Costs for school hearing screening are not known.

11.2. Equipment costs

Costs unknown

11.3. Staff costs

Costs unknown.



12. References

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